

**REMARKS**

Claims 1-9 are all the claims now pending in the application. Claims 10 and 11 have been withdrawn from consideration and canceled.

**I. Election/Restriction**

As a result of the Examiner's restriction requirement, Applicant has elected to prosecute group A (claims 1-9) without traverse. This election was made previously in a telephone conversation with the Examiner on April 2, 2002. Consequently, by and through this amendment, Applicant has canceled claims 10 and 11 without prejudice or disclaimer.

**II. Drawing Objections**

Figures 16, 17A and 17B have been objected to for failing to be designated by a legend such as "Prior Art." Applicant submits herewith new Figures 16, 17A and 17B labeled --Prior Art--. Accordingly, Applicant requests that the objection to the drawings be reconsidered and withdrawn.

**III. Specification Objections**

The Examiner has objected to the specification as containing a number of informalities specifically listed in paragraphs 2-4 of the Office Action dated May 22, 2002. Applicant has corrected the informalities and accordingly requests the Examiner to reconsider and withdraw the objection to the specification.

However, Applicant notes that the Examiner has objected to the use of the word "therebetween" on page 34, line 11, and suggests that it be replaced by "there between." In this

particular instance, the Applicant has not followed the Examiner's suggestion. Applicant submits that the use of "therebetween" is proper and further submits that over 400,000 patents in the PTO use this word. Therefore, Applicant requests that the objection be reconsidered and withdrawn. However, if the Examiner maintains that this is improper, Applicant respectfully requests that the Examiner explain why the use of "therebetween" is improperly used.

#### **IV. Claim Objections**

Claims 7 and 8 stand objected to because the claims are identical. Applicant has amended claim 8 to depend from claim 6, and therefore this objection is now moot.

#### **V. Claim Rejections**

Claims 1 and 2 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Okamoto et al (U.S. Patent No. 5,825,445). Applicant traverses the rejection for at least the reasons discussed below.

To be an "anticipation" rejection under 35 U.S.C. § 102, the reference must teach every element and limitation of the Applicants' claims. A claim is anticipated only if each and every element as set forth in the claim is found either expressly or inherently in a single prior art reference. Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). In fact, the identical invention must be shown in as complete detail as contained in the claim. Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Applicant submits that Okamoto fails to teach the claimed combination. For example, it does not disclose among the claimed elements, the orientation directions of the liquid crystal are limited to within  $\pm 45$  degrees of the short axis direction of the pixel electrode. Since the electric field generated between the signal line, which is arranged in the long axis direction of the pixel region, and the pixel electrode becomes a horizontal field within the short axis direction, the direction of the field coincides with the direction of the liquid crystal molecules. Accordingly, the liquid crystal molecule arrangement oriented in the bend-type orientation is not disturbed by the electric field generated between the pixel electrode and the signal electrode.

In contrast, Okamoto discloses a bend-type liquid crystal display device in which a plurality of signal electrodes and a plurality of scanning electrodes are provided, and a plurality of pixel electrodes are formed at respective cross sections of the signal and scanning electrodes. Okamoto does not disclose the relationship between the orientation direction of the liquid crystal molecules and the short axis direction of the pixel electrodes. As a result, Okamoto fails to teach all of the limitations of claims 1 and 2.

Accordingly, Applicant respectfully requests that the rejection of claims 1 and 2 under 35 U.S.C. § 102(b) be reconsidered and withdrawn.

Claims 3 and 4 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Ueda et al (U.S. Patent No. 5,600,461) in view of Okamoto. Applicant traverses the rejection for at least the reasons discussed below.

The Examiner bears the initial burden of establishing *prima facie* obviousness. MPEP § 2142. To establish a *prima facie* case of obviousness the Examiner must establish that there is

some suggestion or motivation, in either the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. The Examiner states that it would have been obvious to combine the teachings of the references "because the emphasis of the two disclosures are different." See Office Action, paragraph 7. This fact appears to explain why the teachings would not be combined since they address completely different issues. The Examiner makes one final statement that "an active matrix substrate is an integral part of any liquid crystal display." *Id.* Based solely on these two statements, the Examiner attempts to satisfy the burden of providing a motivation to combine the references. Neither of these statements provide an explanation of why one skilled in the art would look to combine the teachings of the cited references. The first statement explains that the two references are directed to "different" concepts while the second statement is makes a general statement regarding what is an integral part of an LCD. What the Examiner has not provided by these statements is a coherent explanation of why one skilled in the art would have combined the teachings of the references. This is the Examiner's burden. The Examiner bears the burden of factually supporting any *prima facie* obviousness conclusion. See MPEP 2142 (emphasis added). It is not the responsibility or burden of the Applicant to create a motivation to combine from two arbitrary statements of the Examiner.

Furthermore, Applicant also submits that the Examiner has not provided the necessary motivation to combine these references because the references are in different technical fields. Ueda discloses a design of a TFT, but it is quite a leap to conclude that the present invention is obvious from TFT disclosed by Ueda a al. and the OCB cell structure disclosed by Okamoto.

The claimed invention was made considering the effect of the parasitic electric field generated by the TFT and the effect of a particular orientation of the OCB, which the references completely ignore. The objective of Ueda is to eliminate cross-talk by reducing the parasitic capacitance between the pixel electrode of the AM liquid crystal and the signal line and the scanning line, while the objective of Okamoto is to obtain wider angle of visibility of the bend-type liquid crystal display device.

In light of the above remarks, Applicant submits that the Examiner has failed to establish a *prima facie* case of obviousness. Applicant requests that the rejection of claim 3 and 4 under 35 U.S.C. § 103(a) be reconsidered and withdrawn.

Claims 5-9 also stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Miyazawa (U.S. Patent No. 6,011,604) in view of Okamoto. To establish a *prima facie* case of obviousness the Examiner must show that the prior art references, when combined, teach or suggest all of the claim limitations. See MPEP § 2143. Applicant respectfully submits that the references cited above by the Examiner fail to teach or suggest all of the claim limitations as set forth in the present application.

Claim 5 recites a bend-type liquid crystal display, in which a compensation electrode is formed in the same layer as that of the scanning line, and in between the pixel electrode and the scanning electrode or the signal electrode for generating an electric field between the pixel electrode and the signal electrode or the scanning electrode. As shown in Fig. 10, since both lines of power for the electric field Ef3 between the pixel electrode 41 and the compensation electrode 17, and for the electric field Ef4 between the signal line 31 and the compensation

electrode 17, fall downward, the electric fields do not affect on the bend-orientation of the liquid crystal molecules Lc located between the pixel electrode 41 and the common electrode 14. In addition, since the electric field between the signal line and the pixel electrode converges to the compensation electrode, the electric field does not leak into the liquid crystal and the liquid crystal does not need to be twisted.

Miyazawa, in contrast, discloses a structure, in which a auxiliary capacitance portion is formed at the portion where the auxiliary capacitance electrode is overlapped with the pixel electrode. Miyazawa does not teach or disclose the bend-type liquid crystal device and the effect by forming the auxiliary capacitance portion is not also disclosed.

Furthermore, Miyazawa fails to teach or suggest that the compensation layer is in the same layer as that of the scanning line or signal line. The Examiner acknowledges that Miyazawa teaches the compensation electrode 35 in a lower layer than the scanning or signal lines. The Examiner also alleges that Figure 9 of the present application shows that "the compensation electrode 17 is actually shown to be in the lower layer than the scanning or signal lines." However, as explained on page 22 of the specification, the compensation electrode 17 is in the same layer as the scanning line 11. The Examiner appears to be mistaking the signal line 31 for the scanning line 11. Nevertheless, by the Examiner's own acknowledgement, Miyazawa fails to teach or suggest this limitation.

col. 5  
line 9

Regarding claim 9, although the opposite surface of the active matrix substrate in Fig. 2 of Miyazawa looks like a flat surface, on the uppermost layer of the opposite surface, an orientation film with a thickness of 1000A is formed, so that it is not possible for the orientation

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film to make the uppermost layer of the substrate surface, which has a roughness in the order of 2000A to 100000A. That is, when the substrate shown in Fig. 2 is formed, the surface roughness of the substrate remains unchanged. In fact, Miyazawa does not teach or suggest that a flat surface nor the effects of such flatness on the disclination.

Accordingly, Applicant respectfully requests that the rejections of claims 5-9 be reconsidered and withdrawn.

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

  
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**APPENDIX**

**VERSION WITH MARKINGS TO SHOW CHANGES MADE**

**IN THE DRAWINGS:**

Attached hereto is a Submission of Formal Drawings.

**IN THE SPECIFICATION:**

**The specification is changed as follows:**

**On page 7, please delete the first full paragraph and replace it with the following new paragraph:**

The change from the spray orientation to the bend orientation is induced by the vertical electric field generated between the pixel electrode and the common electrode. At this time, when the distance between the signal lines and the common electrode is longer than the distance between the pixel electrode and the common electrode, the electric field generated between the surrounding wiring and the pixel electrode is hard to be effused into the liquid crystal layer, so that the bend-type orientation is ~~had hard to be disturbed~~disturb. In order to arrange the pixel electrode at a closer position to the common electrode than the positions of the signal and scanning lines to the common electrode, an insulating layer is formed between the signal and scanning lines and the pixel electrode.

**On page 7, please delete the third full paragraph and replace it with the following new paragraph:**



The electric field generated between the pixel electrode and the signal and 15 scanning lines is generated mainly from an origin located at respective end portions. Accordingly, if the end portions of the pixel electrode ~~overlap~~overlap through an insulating layer with the end portions of the signal and scanning lines, since the electric field generated between the pixel electrode and the signal and scanning lines is generated at the rear side of the pixel electrode, the effect of ~~the electric field on~~ the vertical electric field is further reduced.

**On page 9, please delete the first full paragraph and replace it with the following new paragraph:**

The tilt angle of the liquid crystal molecules is liable to be affected by irregularities of the substrate surface. That is, if the substrate surface is inclined in the direction opposite to the ~~tile~~tilt angle, the liquid crystal molecules will be oriented in undesirable directions, which may disturb the normal bend-type orientation of the liquid crystal molecules. If irregularities of the opposing surface of the active matrix substrate, formed by repeated lamination and etching, can be eliminated and a flat and smooth surface is obtained, tilting of the liquid crystal molecules in the undesirable direction can be prevented and the normal bend-type orientation can be obtained. The flat and smooth surface can be provided by formation of a thick organic insulating film.

**On page 14, please delete the second full paragraph and replace it with the following new paragraph:**

A chromium film having a thickness of 0.2  $\mu$  m is formed on a substrate 1 by a ~~spattering~~sputtering method, and scanning lines 11 and gate electrodes 12 are formed by patterning the chromium film by photolithography. It is noted that, although the chromium is described as

above, the other metal materials, having low electric resistivities and which can be patterned by photolithography, such as molybdenum, titanium, aluminum, aluminum alloys may be used. In addition, the scanning lines 11 and the gate electrode 12 may be formed not only by the chromium film but also by the composite film laminated with a barrier metal of titanium on the chromium film. Subsequently, a silicon nitride film with a thickness of 0.5  $\mu$  m is formed as the gate insulating layer 2 by chemical vapor deposition (hereinafter, called CVD). On the gate insulating layer 2, an undoped A-Si layer and n+ type a-Si are formed by CVD for forming an a-Si film 15 by patterning these CVD films. Here, the a-Si film is used as an active layer of the transistor, and the n+ type a-Si is used for ensuring ohmic contact between the drain electrode 32 and the source electrode 33.

**On page 14, please delete the third full paragraph and replace it with the following new paragraph:**

Subsequently, contact holes for electrically connecting the signal lines, the source electrode, and the drain electrode with the conductive layer for forming the pixel electrodes are formed by patterning the gate insulating layer 2. It ~~is~~ may not be necessary to form contact holes ~~may not be necessary if they are required~~. It may be possible to provide conductivity in ~~other~~ ways other than the use of contact holes. Subsequently, a chromium film with a thickness of 0.2  $\mu$  m is formed on the a-Si film 15 and the n+ type a-Si 16 and the signal lines 31, the drain electrode, and the source electrode are formed by ~~sputtering~~ sputtering the chromium film. Although the chromium film is used for forming the signal lines, it is possible, as for the scanning lines, to use other metals such as molybdenum, titanium, aluminum, and aluminum

alloy, when the metals have low resistivity and can be patterned by photolithography. In addition, the scanning lines 11 and the gate electrode 12 may be formed not only by the chromium film but also by a composite film laminated with a baffler metal of titanium on the chromium film.

**On page 17, please delete the first full paragraph and replace it with the following new paragraph:**

Further, a potential difference is generated between the signal lines 31 and the pixel electrode 41, which is a parasitic potential which is not originally desired. Since the signal lines 31 and the pixel electrodes 41 are arranged horizontally on the same layer, the electric field  $E_{f2}$  generated by this potential difference is a horizontal electric field, and the directions of the force lines coincide with the short side axis A-A', that is, the orientation direction  $O_r$  of the liquid crystal molecules. Accordingly, this horizontal electric field  $E_{f2}$  does not change the liquid crystal molecules into a twisted orientation before the liquid crystal molecules change to the bend-type application mode. Thus, by arranging the orientation directions  $O_r$  of both substrates facing each other to tend toward the short side axis A-A', the effect of the horizontal electric field on the liquid crystal molecules can be avoided. A similar effect can be obtained when the liquid crystal is oriented in the inverted direction by rotating 180 degrees. Practically, this effect can be realized when the orientation tends toward a direction within  $\pm 45$  degrees of the short side of the pixel region. ~~Similar to the above case, it is a matter of course that~~ Accordingly, a parasitic horizontal electric field is generated ~~in this case~~ between the scanning lines and the pixel electrodes. However, since the length of each scanning line facing the pixel electrode is

small (that is, ~~since the~~ since the scanning lines face to the pixel electrode in the direction of the short side axis), the effect of the parasitic electric field is small. In addition, in this constitution, which is described later, since the scanning lines are formed in a lower layer than the layer of the pixel electrode, the parasitic electric field will not penetrate too much into the cell gap.

**On page 19, please delete the first full paragraph and replace it with the following new paragraph:**

Similar to the first embodiment, the scanning lines 3 and the gate electrode 12 are formed by forming a chromium film with a thickness of  $0.2\ \mu\text{m}$  and by patterning by the photolithographic technique. Then, the silicon nitride film for forming the gate insulating layer 2 is deposited at a thickness of  $0.5\ \mu\text{m}$ . On the gate insulating layer 2, an undoped a-Si and an n+-type a-Si layer are deposited by CVD, and by patterning these layers, the a-Si layers 15 are formed. Subsequently, contact holes are formed by patterning the gate insulating layer 2 in order to conductively connect the conductive layer including the scanning lines 11 and the conductive layer including the signal lines, the source electrodes, and drain electrodes, which are formed in a later process. These contact holes are formed when they are necessary. The conduction may be obtained by other methods. Subsequently, a chromium film with a thickness of  $0.2\ \mu\text{m}$  is formed by ~~sputtering~~ sputtering on the a-Si layer 15 and the n+ -type a-Si layer and, by patterning, the signal lines 31, drain electrodes 32, and source electrodes 33 are formed. Subsequently, dry etching is executed using a gas, which is capable of etching the n+-type a-Si, for removing the n+ -type a-Si layer located between the drain electrodes 32 and the source electrodes 33. Subsequently, the silicon nitride film is formed by CVD with a thickness of  $0.2\ \mu\text{m}$  for forming

the intermediate insulating layer 9. The intermediate insulating layer 9 not only functions as the intermediate layer between the layer including the pixel electrodes and the layer including signal lines etc., but also functions as a protective insulating layer 3 as described in the first embodiment for preventing impurity ions from penetrating in the a-Si layer and prevents the thin film transistors from causing a malfunction. Subsequently, the orientation film made of polyimide resin is formed by a printing method, and after firing at 220°C, the orientation film is orientation treated in the short side direction by a rubbing process.

**On page 23, please delete the fourth full paragraph and replace it with the following new paragraph:**

The same processes as those of the second embodiment are followed until forming the pixel electrode 41, and the n+-type a-Si film located between the drain electrode and the source electrode is removed. Subsequently, a flat protective insulating layer is formed by spin coating an acryl-base transparent resist into a thickness from 1  $\mu$  m to 4  $\mu$  m and by firing the coat. In this manufacturing process, an acryl base resist has been used, but it is possible to use other resists; ~~for~~ For example, polyimide-type resists, can be used if a flat surface is obtained. It is preferable to use benzocyclobutene or polysilazane containing silicone in the coatable state in order to improve the protective function of the a-Si layer. It is also possible to use silicon nitride film before coating the acryl-type resist film.

**On page 24, please delete the first full paragraph and replace it with the following new paragraph:**

In addition to forming the flat surface by coating the resin film, it is also possible to form an insulating layer by CVD or ~~spatterings~~sputtering, and to grind the surfaces of films for finishing to flat films. A very flat surface obtained by grinding the insulating film deposited by CVD or ~~spattering~~sputtering allows high precision patterning, and the thus formed insulating film provides a layer with high thermal resistance.

**IN THE CLAIMS:**

**Claims 10-11 are canceled.**

**The claims are amended as follows:**

8. (Amended) An OCB-type liquid crystal display device according to claim 56, wherein said compensation electrode is formed so as to connect to the scanning line of the adjacent pixel region.